Project B-209

PHARMACEUTICAL PREPARATIONS
A MANUFACTURING OPPORTUNITY IN GEORGIA

Prepared for
The Georgia Department of Commerce
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by

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Foreword

The second in the new special industry studies in preparation for the Georgia Department of Commerce, this analysis points up three major advantages which pharmaceutical manufacturers can achieve through a Georgia location.

Like many of the earlier studies, it points up a combination of a large and growing market which can be served more economically in the area through the reduction of freight costs, plus lower production costs through more efficient operations.

Additional specifics pertinent to the needs of individual companies will be prepared in confidence on request.

Comments or questions regarding the study are invited.

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Summary

Three factors support the belief that pharmaceutical manufacturers would profit appreciably with Georgia branch plants:

1. Twenty-three percent of the U. S. market is in an area where freight costs would be cheaper from Georgia than from either Chicago or New York.
2. Many plants have grown so large that they are no longer as efficient as the smaller ones.
3. Manufacturing costs would be lower in Georgia.

There were over $1 billion in retail sales in pharmaceutical products in the Georgia freight advantage area (see Map 1), representing over $530 million at the manufacturers' sales price in 1962. This represents 23% of total U. S. sales. Sales of pharmaceuticals for human use in 1967 should be 37% greater than the 1960 sales.

In addition, Georgia is recognized as the center of a special market for drugs used to treat poultry. Georgia ranks first in broiler production, accounting for 18% of the national total. The five-state southeastern area[1/] is estimated to have $5.7 million in manufacturers' sales annually for vaccines for bronchitis and Newcastle disease.

Pharmaceutical production facilities concentrated in the northeastern quarter of the U. S. account for 87% of the U. S. production. In contrast, the markets are spread over the entire country. Approximately 42% is produced outside of the area in which it is consumed. The imbalance between production and markets is largest in the South, with 24% of U. S. production being shipped into the area that accounts for 30% of the U. S. market.

The northern pharmaceutical plants with over 1,000 employees may find after critical examination that their operations would be more productive if they establish southern branches. The larger plants, compared with the medium size plants in the industry, pay higher wages and realize less value added per dollar of payroll, as well as less production per worker.

The national markets can be served from a Georgia plant more economically than from an Illinois, New York or California plant. By comparing production

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1/ Alabama, Florida, Georgia, North Carolina and South Carolina.

labor costs and freight costs between plants located in Atlanta, New York, Chicago and Los Angeles, an Atlanta plant would have 11% to 19% higher earnings than the other locations. In addition, a Georgia plant would have the advantage of lower taxes, lower utility costs and lower construction costs.

With a branch plant in Georgia serving only the southern market, the freight savings would be from 37% to 75% of the freight bill at the other locations.

All types of containers and packaging materials are produced in Georgia -- glass, plastic, metal, paper, fiber and wood. For many pharmaceutical products the container and packaging materials are a major part of the shipping weight; thus, another advantage is realized by the economical source of supply for such packaging materials.

INTRODUCTION

The pharmaceutical preparations industry includes establishments primarily engaged in manufacturing, fabricating or processing drugs in pharmaceutical preparations for human or veterinary use. Most of the products are finished in the form intended for final consumption, such as ampoules, tablets, capsules, ointments, medicinal powders, solutions and suspensions. Many of the raw materials are procured from basic chemical processors.

The following pharmaceutical preparations account for more than half of the total ethical drug sales in the United States:

Product	Proportion of Total Ethical Sales
Antibiotics	22%
Hormones	9%
Ataraxics	8%
Cardiovasculars	6%
Vitamins and Hermatinics	6%
Analgesics	5%
Total	56%

This study is concerned with the feasibility of establishing manufacturing operations in Georgia to serve either the national or southern market. The present and future markets are considered, and a special area market for pharmaceuticals used in the poultry industry is explored. In pointing out the characteristics of the industry, the concentrated production centers and the dispersed regional markets are contrasted, and operating characteristics of different size plants are compared.

In considering the advantages of having a pharmaceutical plant in Georgia, this report concentrates on the labor and freight advantages the Georgia plant would have. Georgia's many other attractions are also analyzed: construction costs, natural gas rates, electric rates, property taxes, and the availability of containers and other packaging materials.

THE MARKET FOR PHARMACEUTICAL PREPARATIONS

The National Market

Manufacturers' sales of pharmaceuticals for human use in the United States amounted to over $2 billion dollars in 1960.[1/] Pharmaceuticals for use in treating livestock, poultry and pets accounted for more than $100 million in manufacturers' sales in the same year. Over the past 12 years total sales have grown at an average rate of over 8% a year.[2/]

Ethical sales for human use are made through three types of outlets: prescription shops, hospitals and physicians. Overall prescriptions account for 60% of the sales, while 21% are sold to hospitals and 19% to physicians. However, the sales profile as well as the per capita sales vary between the states. A breakdown of these sales by states has been used to estimate the markets in the South.

Manufacturers' sales of pharmaceuticals for human use are expected to reach almost $3 billion by 1967 -- a 37% increase over 1960 sales. The forecast is based on a projection of per capita consumption and an authoritative forecast of population. Other specialists have forecast a much greater increase in sales, even in excess of 90%. Details are given in Appendix 2. Regardless of the forecast used, tremendous growth is predicted for the pharmaceutical industry.

The Southeastern Market

The southeastern market in this report is the area that a Georgia plant can supply at a lower shipping cost than a plant located in Chicago or New York. Atlanta was used to fix the shipping point in Georgia, and Chicago and New York are representative centers for the present producers. The Georgia freight advantage area comprises all of seven states and parts of seven others. (See Map 1.) Eleven states[3/] were chosen as representative of the freight advantage area for purposes of measuring the area's market.

1/ 1960 NWDA Drug Market Data, National Wholesale Druggists' Association.

2/ "Summary of 1960 Sales of Drug Store Products," Drug Topics, July 17, 1961.

3/ Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and Texas.

MAP 1

GEORGIA FREIGHT ADVANTAGE AREA

Manufacturers' total sales in the freight advantage region are estimated to be over $530 million in 1962, representing retail sales of more than $1 billion. In 1960, area sales of pharmaceuticals for human use amounted to 23% of U. S. sales, or $496 million at the manufacturers' level and $936 million at the retail level.

The freight advantage area contained 41.68 million people in 1960, which is 23% of the total U. S. population. The regional market estimate did not involve use of per capita averages but was based on sales in each category for each state. More information is given in Appendix 1.

For ethical sales, the pattern in the freight advantage area varies from the national pattern in that prescriptions have a higher share of the sales and physicians purchase less. The following list enables comparison:

	% of U. S. Sales	% of Georgia Freight Advantage Area Sales
Prescription Sales	60.3	62.9
Hospital and Institutional Purchases	21.0	21.1
Physician Purchases	18.7	16.0
Total Ethical Sales	100.0	100.0

The 1967 sales estimate for the 11-state freight advantage area is almost $680 million at the manufacturers' sales price -- a 37% increase over 1960 sales.

The Wholesale Market

The southeastern wholesale market is centered in Atlanta, which has a total annual wholesaling volume of about $4 billion. This places it $1.5 billion ahead of its nearest competitor in the Southeast (Memphis).

In the wholesaling of drugs, drug proprietaries, druggists' sundries, and toiletries, Atlanta not only stands fourth in the nation behind New York, Chicago and Los Angeles, but it is far ahead of the city that ranks fifth.

A total of $233 million worth of drugs, drug proprietaries, druggists' sundries and toiletries was wholesaled in Atlanta in 1958. The entire New England area in the same year wholesaled only $246,900,000, while sales in the states of Florida, North Carolina and South Carolina combined were only $235,884,000. Twenty-five per cent of all the wholesale sales of these

products in the eight South Atlantic states, the District of Columbia, and the four East South Central states combined are made in Atlanta.

Special Area Market[1/]

The large poultry industry in Georgia and the surrounding states provides a special market for certain pharmaceuticals. Shown below are data relating to the quantity of poultry produced in the five-state area of Alabama, Florida, Georgia, North Carolina and South Carolina and the area's production as a percentage of the national total.[2/]

	Georgia	Five-State Area	Five-State Area % of National Total
Broilers	320,250,000	676,313,000	38
Layers	13,289,000	45,041,000	13

Georgia ranks first in broiler production in the nation, accounting for 18% of the national total.

The standard practice in the poultry industry is to vaccinate every day-old chick for bronchitis and Newcastle disease before it leaves the hatchery. In the broiler industry, it is estimated that at least one-half of these chicks are re-vaccinated on the farm. It is standard practice for all layers to be re-vaccinated on the farm at housing age (16 to 18 weeks). In 1960, the market potential for Georgia was 543,403,000 doses, and the five-state area was 1,141,001,000 doses. Assuming a price per dose of 0.5 cents, manufacturers' sales are estimated to be $2.7 million in Georgia and $5.7 million in the five-state area annually.

Pharmaceuticals are also used as feed additives in the poultry industry. Based on the standard practice of fortifying feed during the early growing period of baby chicks, Georgia's market potential in 1960 for an antibiotic-

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1/ Information in this section based on report prepared on pharmaceuticals used in the poultry, cattle, and swine industry in Georgia, Alabama, Florida, North Carolina and South Carolina by Oliver Terriberry, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology.

2/ Agricultural Marketing Service Crop Reporting Board, Livestock and Poultry Inventory, January, 1961.

bacitracin or nitrofuran-type material was 23 pure tons, and the five-state area's requirement was 41.7 pure tons.[1/]

By accepted practice, worming materials are used to treat broilers once during their lives, and layers are treated twice prior to housing and then once every 30 days during their laying life of 10 to 14 months.

The most commonly used materials in worming compounds are piperazine salt and phenolthiazine. In 1960, 1,240 tons of piperazine were consumed in Georgia, and 3,500 tons were consumed in the five-state area, based on 16.9% active piperazine salt. Consumption includes material used by the livestock industry.

1/ 100% concentration basis. Broilers consume seven pounds of feed per bird of which 8% is fortified. Layers consume 22 pounds of feed per bird during the growing period, of which two pounds are fortified as a standard preventive practice.

CHARACTERISTICS OF THE PHARMACEUTICAL PREPARATIONS INDUSTRY

Location of the Industry and Its Markets

Almost 87% of the production of pharmaceuticals is concentrated in the northern manufacturing belt (Northeastern and East North Central states). New York and New Jersey together account for 39% of U. S. production, and the East North Central states account for 32%. The top producing states are listed in Table 1 in descending order.

Table 1

LEADING STATES IN VALUE OF SHIPMENTS FOR PHARMACEUTICAL PREPARATIONS

State	Percent of U. S.
New York	24
New Jersey	15
Indiana	12
Michigan	10
Pennsylvania	10*
Illinois	8

* Estimated.

Source: United States Census of Manufactures: 1958, U. S. Department of Commerce, Bureau of the Census, SIC 2834.

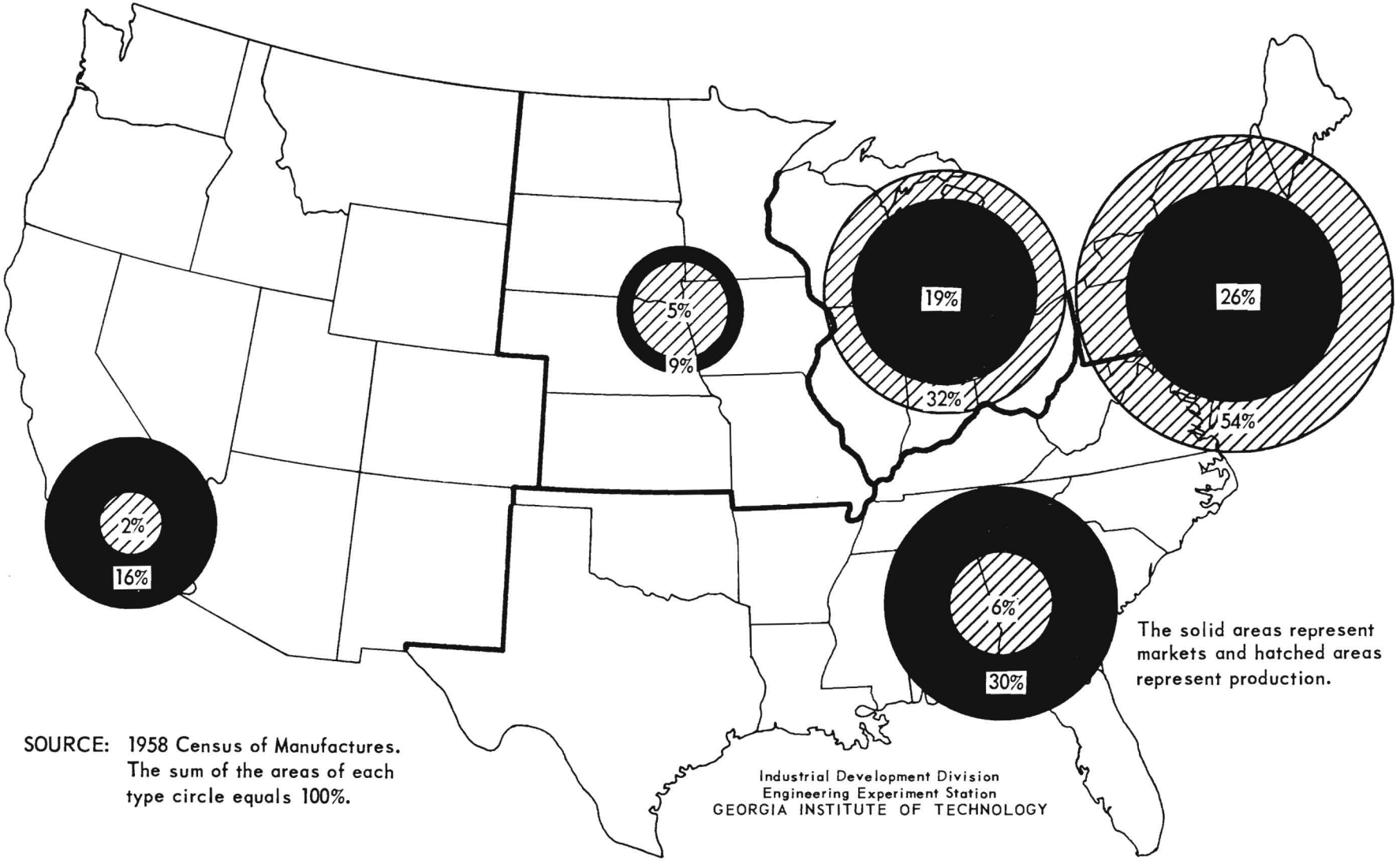
In contrast, the markets for pharmaceuticals are spread over the entire country. Consequently, production locations are out of balance with the markets. Approximately 42% of all pharmaceuticals are produced outside of the general area where they are consumed. Table 2 and Map 2 show a comparison of production and market locations. The largest deficit of production is in the South, which imports into the area 24% of the U. S. production in order to supply a market amounting to 30% of the total U. S. consumption.

Plant Size Comparisons in the Industry

Statistics from the 1958 Census of Manufactures provide a basis for comparing the different sizes of establishments in the pharmaceutical preparations industry (SIC 2834). The following study of industry statistics indicates that the 14 plants that have over a thousand employees

MAP 2

COMPARISON OF THE LOCATION OF THE PHARMACEUTICAL INDUSTRY WITH THE DISTRIBUTION OF THE MARKETS FOR PHARMACEUTICALS



The solid areas represent markets and hatched areas represent production.

SOURCE: 1958 Census of Manufactures. The sum of the areas of each type circle equals 100%.

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Table 2

MEASURE OF BALANCE BETWEEN PRODUCTION AND MARKETS FOR PHARMACEUTICALS

Area	Value of Shipment (% of U. S.)	Consumption (% of U. S.)	Balance	
Northeast	54.39	25.83	+ 28.56	
East North Central	32.41	19.01	+ 13.40	+ 41.96
West North Central	4.93	8.86	- 3.93	
South	6.01	30.05	- 24.04	
West	2.21	15.77	- 13.56	- 41.53

(+) Area manufactures more than it consumes.

(-) Area manufactures less than it consumes.

Source: United States Census of Manufactures: 1958, U. S. Department of Commerce, Bureau of the Census, SIC 2834.

each probably would be more productive if operations were decentralized and branch plants were located in areas where product consumption is high relative to production.

The establishments of the pharmaceutical preparations industry are divided by number of employees into 10 size groups. The smallest has an employment range of one to four employees and the largest has 2,500 or more employees. The average annual salary paid per employee is compared for the different size establishments in Figure 1. This comparison shows that the larger the plant, the higher the average annual salary, varying from $3,200 for the smallest plants to $6,540 for the largest plants.

When comparing the value added per dollar of payroll for the different size establishments, three of the groups stand out. (See Figure 2.) The three groups covering plants having between 100 and 1,000 employees show the greatest value added per dollar of payroll. The ratios shown on the chart indicate that a plant's efficiency apparently declines as plant size grows beyond a critical point.

The ratio of the average production per employee for the group to the industry average is compared for the different groups in Figure 3. Again, the establishments employing between 100 and 1,000 are outstanding in this measure of employee productivity for the industry, exceeding the industry average by about 20%.

COMPARISON OF STATISTICS FOR THE DIFFERENT SIZE PLANTS IN THE PHARMACEUTICAL PREPARATIONS INDUSTRY

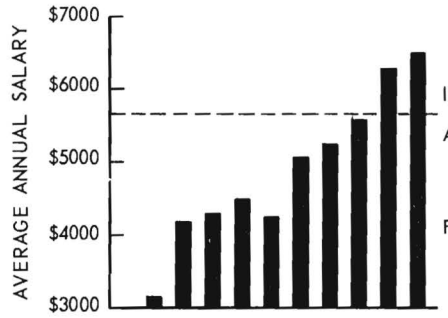

Figure 1. Average Annual Salary by Size of Establishment.

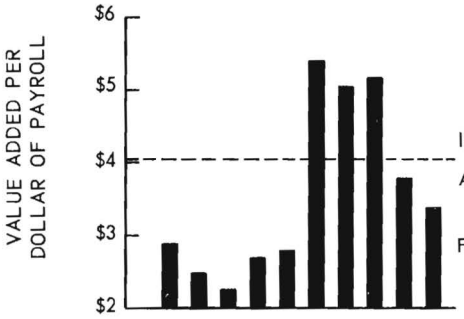

Figure 2. Value added per Dollar of Payroll by Size of Establishment.

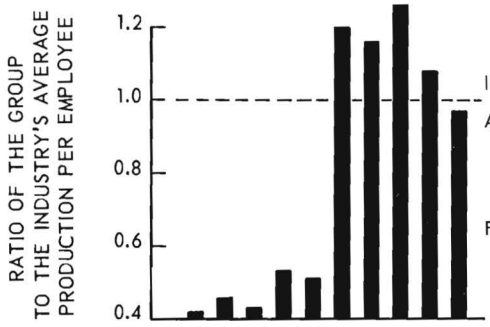

Figure 3. Comparison of the Ratio of Average Production per Employee for the Group to the Industry Average.

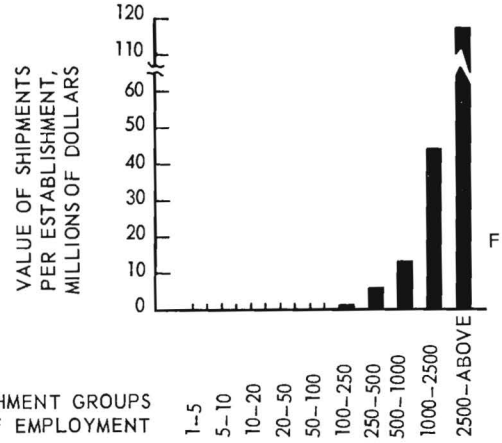

Figure 4. Average Value of Shipments per Establishment by Groups.

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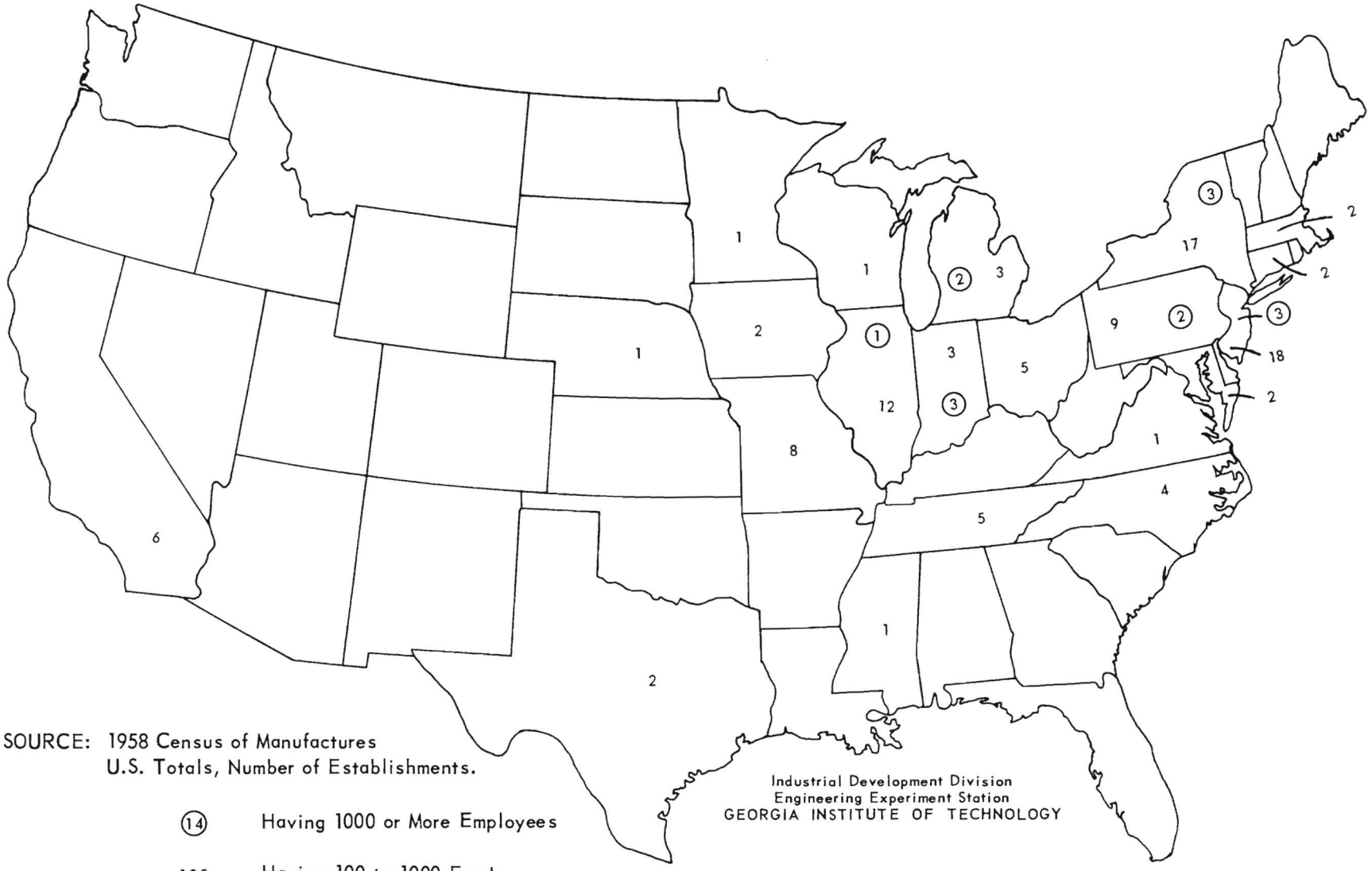
SOURCE: *United States Census of Manufactures: 1958*, U.S. Department of Commerce, Bureau of the Census, SIC 2834.

Of the total of 1,114 establishments in 1958, 10.7% accounted for 90.7% of the value of shipments. The smallest size group, averaging two employees per establishment, accounted for 45.2% of the number of establishments but only 0.6% of the value of shipments. (See Figure 4.)

The location of the medium and large size establishments (100 employees and more) is shown by state on Map 3. The 14 largest establishments of over 1,000 employees each are located in the six states listed in Table 1 as the leading states in value of shipments for pharmaceutical preparations.

MAP 3

LOCATION OF THE MEDIUM AND LARGE SIZE PLANTS, ETC.



SOURCE: 1958 Census of Manufactures
U.S. Totals, Number of Establishments.

(14) Having 1000 or More Employees

105 Having 100 to 1000 Employees

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ADVANTAGES OF A GEORGIA LOCATION FOR PRODUCTION FACILITIES OF THE PHARMACEUTICAL PREPARATIONS INDUSTRY

A national manufacturer of pharmaceutical products could more profitably serve either national or southern markets from a plant located in Georgia than from established plants in the northern manufacturing belt due principally to lower labor costs and advantages to be derived from lower transporation costs.

Labor Costs

In the pharmaceutical preparations industry (SIC 2834) the average production wage in 1958 for the United States was $2.25 per hour. As indicated in Table 3, the average wage by states and regions ranged from a low of $1.56 per hour to a high of $2.68 per hour.[1/]

Table 3

AVERAGE PRODUCTION PAY RATES
IN THE PHARMACEUTICAL PREPARATIONS INDUSTRY
FOR STATES AND REGIONS[1/]

State or Region	Average Pay Rate	
	Per Hour	% of U. S. Average
Michigan	$2.68	119
Indiana	2.56	114
East North Central States	2.47	110
New Jersey	2.35	104
United States	2.25	100
Northeast	2.25	100
Illinois	2.22	99
New York	2.19	97
California	2.06	92
Ohio	2.04	91
Missouri	1.91	85
Wisconsin	1.87	83
West North Central States	1.86	83
West South Central States	1.75	78
Texas	1.71	76
North Carolina	1.60	71
East South Central States	1.59	71
South Atlantic States	1.56	69

Source: United States Census of Manufactures: 1958, U. S. Department of Commerce, Bureau of the Census, SIC 2834.

1/ States and regions where general statistics are disclosed and that have five or more establishments with 20 or more employees.

Although the average wage for Georgia is not revealed, it is approximately the same as the average for the South Atlantic states, which is $1.56 per hour or 69% of the U. S. average. Statistics for Georgia have been withheld by the Bureau of the Census to avoid disclosing figures for individual companies. Georgia had 13 establishments listed under SIC 2834 in 1958.

Comparing Georgia with representative locations in the manufacturing belt (New York and Illinois) and California, labor savings in Georgia range from 24% to 30% of production labor cost. These are:

When Compared to the Average Plant in:	Production Labor Savings for a Georgia Located Plant
Illinois	30%
New York	29%
California	24%

Freight Costs in Serving the National Market

Four plant locations were selected for determining the freight bill in serving the national market -- Atlanta, New York, Chicago and Los Angeles. The destination points for shipments from the plants are the principal cities of the 37 wholesale drug areas of the continental United States as defined by the National Wholesale Druggists' Association. By using these areas the freight bill could be calculated for the actual sales in each area. The freight bill as a percent of the plants' sales is:

Plant Location	Freight Bill as a Percent of Plant Sales
Atlanta	1.52
New York	1.67
Chicago	1.39
Los Angeles	3.34

Effect of Labor and Freight Costs on Earnings

As a result of savings in labor and freight costs, the earnings of an Atlanta plant would exceed earnings for plants in the other locations being compared by:

19% over Los Angeles,
12% over New York and
11% over Chicago.

These figures are the result of using the averages for the United States and determining the influence of wages and shipping costs on earnings. (See Table 4.) The effect on earnings for the difference in local and state taxes, utility costs and construction costs is not included. However, other industry studies by the Industrial Development Division of the Georgia Institute of Technology have evaluated these factors and found that Georgia plants have the advantage.

Table 4

INFLUENCE OF WAGES AND SHIPPING COSTS ON EARNINGS

	U. S. Average 1/	Georgia (Atlanta)	New York (New York City)	Illinois (Chicago)	California (Los Angeles)
Production pay rate:	$2.25 hr.	$1.56 hr.	$2.19 hr.	$2.22 hr.	$2.06 hr.
Production wages as a % of plant sales:	7.93%	5.50%	7.72%	7.83%	7.26%
Shipping cost as a % of plant sales:	1.57%	1.52%	1.67%	1.39%	3.34%
Earnings as a % of plant sales:	20.00%	22.48%	20.11%	20.28%	18.90%

1/ Based on 1958 Census of Manufactures.

Freight Costs in Serving the Southern Market

Comparing the freight bill for serving the South for plants located in Atlanta, New York, Chicago and Los Angeles, freight savings for the Georgia plant range from 37% to 75%. Wholesale drug areas were used in defining the southern market. These areas do not correspond exactly to the freight advantage area shown in Map 1. The 10 areas used account for 20% of the U. S. sales, while the freight advantage area has 23% of the U. S. sales. The effect of this difference is to understate the freight advantages of the Georgia plant. Freight savings over each location are shown below:

When Compared to a Plant Located in:	Freight Savings for a Georgia Located Plant
New York	54%
Chicago	37%
Los Angeles	75%

Other Factors

The cost advantages of a Georgia plant over present plants are increased by the following factors:

1. Lower capital investment is required for a given production capacity in Georgia than in the Northeast. This lowers the amount spent on property taxes and increases the per cent return on the investment as well as increases the actual earnings.

Construction costs are proven to be low. Leading contractors are building plants in the Atlanta area at costs that are 14% to 40% less than construction costs elsewhere. For example, one company recently accepted bids for plants built to the same plans at two different locations. The bid in Atlanta was $60,000; on a site in New Jersey, the bid was $95,000. Another comparison under the same conditions found Atlanta costs 20% lower than costs in a central Illinois town.

Contractors claim the main reason that construction costs are lower in Atlanta are climate and worker productivity. There are more working days under favorable weather conditions. The attitudes of the workers -- both union and non-union -- are superior and permit effective use of new labor-saving tools.

2. Natural gas rates in Georgia are 30% to 50% of the rates in the New York area. Additional savings are realized because of the milder and shorter winters in Georgia.

3. Electric rates in Georgia are 60% to 80% of the rates in the New York area.

4. Taxes in Georgia are lower than in many other places. Some specific examples are listed in Table 5.

Table 5

GEORGIA PROPERTY TAX COMPARISONS

Georgia Location:	Compared to:	Georgia Tax ÷ Compared Tax 1/
Clayton County (Atlanta Area)	Caldwell Township, Essex County, New Jersey	64%
Atlanta, Fulton County	Newark, Essex County, N.J.	38%
Clayton County (Atlanta Area)	Buffalo, Erie County, New York	40%
Clayton County	Cook County, Illinois (Chicago Area)	54%
Clarke County (Athens Area)	Wheeling, Ohio County West Virginia	97%*

*When comparing not only property taxes, but also West Virginia's Business and Occupation Tax and Georgia's Corporate Income Tax and Franchise Tax, the Georgia tax bill is 44% of the West Virginia tax bill.

Source: Case studies and files, Industrial Development Division, Georgia Institute of Technology.

1/ Georgia property tax bill as a percentage of the tax bill in the place being compared, based on equal investment.

Manufacturers of Containers in Georgia

Container and box manufacturers in the area are a primary advantage to a drug manufacturer. Located in Georgia are plants manufacturing metal, plastic and glass containers. These are listed in Table 6.

In addition, there are many manufacturers of paper fiber and wood containers located in Georgia. The number of plants are listed by Standard Industrial Classification (SIC) in Table 7.

Containers and packaging materials are a major part of the shipping weight of many pharmaceuticals.

Table 6

MANUFACTURERS OF METAL, PLASTIC AND GLASS CONTAINERS IN GEORGIA

Plant	Location	Products
American Can Company	Atlanta (Forest Park)	Oblong cans, beer cans, carbonated beverage cans, paper tubes with metal ends, lithographing facilities
American Can Company	Savannah	Coffee cans and other cans
Crown Cork & Seal Company	Atlanta	General open top cans, aerosol cans, aluminum cans, beer cans, bottle crowns, oblong cans, lithographing facilities
Knox Glass Company	Atlanta (Forest Park)	Glass containers
Owens-Illinois Glass Co. Glass Container Division	Atlanta	Glass containers
Plastic Products Division	Atlanta	High density polyethylene bottles
Polyco, Inc.	Atlanta (Smyrna)	High and low density polyethylene bottles

Table 7

NUMBER OF MANUFACTURERS OF PAPER FIBER AND WOOD CONTAINERS IN GEORGIA

SIC	Number of Plants	Products
2651	6	Folding paperboard boxes
2652	7	Set-up paperboard boxes
2653	14	Corrugated and solid fiber boxes
3654	10	Sanitary food containers
2655	8	Fiber cans, tubes, drums and similar products
2441	14	Nailed and lock corner wooden boxes and shook
2442	20	Wirebound boxes and crates
2443	6	Veneer and plywood containers, except boxes and crates

Conclusion

Greater earnings are possible in serving either the national market or the southern market when the pharmaceutical items are produced in Georgia rather than being produced in the northeastern quarter of the U. S. While increased earnings of between 10 and 20 percent can be shown for a hypothetical company, the actual increase in earnings that a specific company would realize can only be determined from a case study for that company. Individual studies can be made for interested companies.

APPENDICES

Appendix 1

NATIONAL AND SOUTHERN MARKETS

The National Wholesale Druggists' Association published the "1960 NWDA Drug Market Data" which contains detailed market estimates. Sales in the U. S. and the 11 southern states are shown in Appendix Table 1-A.

Appendix Table 1-A

SALES OF PHARMACEUTICALS FOR HUMAN USE
(In Millions of Dollars at Manufacturers' Prices)

State	Total Ethical Sales	Percent of U. S.	Percent of U. S. Ethical Sales		
			Prescription	Hospital	Physician
Alabama	25.00	1.6205	1.7999	1.5458	1.1232
Arkansas	15.69	1.0166	1.0576	0.9048	1.0126
Florida	39.78	2.5785	2.7742	2.4180	2.1289
Georgia	31.65	2.0523	2.1190	1.1315	1.7464
Kentucky	25.00	1.6210	1.5674	1.6716	1.7354
Louisiana	30.89	2.0029	2.1519	1.8624	1.6778
Mississippi	15.67	1.0155	1.0924	1.0059	0.7789
No. Carolina	31.16	2.0208	1.7827	2.7405	1.9873
So. Carolina	17.80	1.1540	1.1309	1.1588	1.2232
Tennessee	30.64	1.9866	2.1097	2.0538	1.5136
Texas	94.49	6.1250	6.5893	5.8523	4.9333
Total	357.79	23.1937	24.1750	23.3454	19.8606
U. S. Total	1,542.61	100.0000	100.0000	100.0000	100.0000
U. S. Sales			$930.81	$323.59	$288.22
11-State Sales			$225.02	$ 75.54	$ 57.24
Percent of ethical sales, 11-state area			62.89%	21.11%	16.00%
Percent of ethical sales, U. S. total			60.34%	20.98%	18.67%

The following information was used in the market calculations. All dollars are in millions.

Proprietaries sales, 1960, U. S. Total:	$616.94
11-state sales estimate using prescription sales percentage:	$149.15
11-state total of ethical and proprietaries, 1960:	$506.93
Gross margin from manufacturers' to wholesalers' price:	17.16%[1/]
Gross margin from wholesalers' to retail price:	36.00%[2/]

1/ Average from August 1962, Lily Digest.

2/ Ibid.

Resulting gross mark-up from manufacturers' to retail price as percent of manufacturers' price:	88.6%
11-state retail sales, 1960:	$956.08
Change in retail sales of drugs from 1960 to 1961:	+ 3.4%[1/]
11-state retail sales, 1961:	$988.58

Freight advantage area, Atlanta over Chicago and New York

Percent of the 11-state population	97.9%

Pharmaceutical Preparations Sales:

	Retail Price	Manufacturers' Price
1960	$ 936.00	$496.29
1961	$ 967.82	$513.16
1962 Estimate	$1,000.00	$530.22[2/]

Livestock, Poultry and Pet Health Aids

1960 retail sales:[3/]	$238,190,000
1960 sales at manufacturers' sales prices:	$105,161,000

The retail sales reported by Drug Topics are converted to manufacturers' sales dollars by a factor that not only include mark-up but also includes a correction in the relative bases between Drug Topics' sales figures and NWDA sales figures. The resulting manufacturers' sales dollars in the veterinary category can therefore be added to the sales for human use. The converting factor is obtained by correlating data between the two sources:

Drug Topics 1960 retail drug store sales total	$7,711,000,000
NWDA 1960 drug store sales in manufacturers' dollars:	$3,404,397,600
Ratio of Drug Topics to NWDA:	2.265

1/ Source: Drug Topics Annual Sales Survey. Obtained by combining the prescription and packaged medication sales and subtracting the duplications.

2/ Represents a 3.3% increase over 1961. Percentage increases have been greater than this from 1954 through 1961.

3/ Source: Drug Topics Annual Sales Survey.

Appendix 2

MARKET FORECAST CALCULATIONS

The growth in annual sales of pharmaceutical products from 1949 to 1961 is measured by using data published annually by Drug Topics. Three items are combined: prescription sales and packaged medication are added, and from this the duplication figure is subtracted. The annual sales figure is converted to an index number with 1960 equaling 100. The index is plotted in Appendix Figure 2-A.

Per capita sales are obtained by dividing annual sales by population and then converted to an index with 1960 equaling 100. This index is plotted in Appendix Figure 2-B. The figures are listed in Appendix Table 2-A.

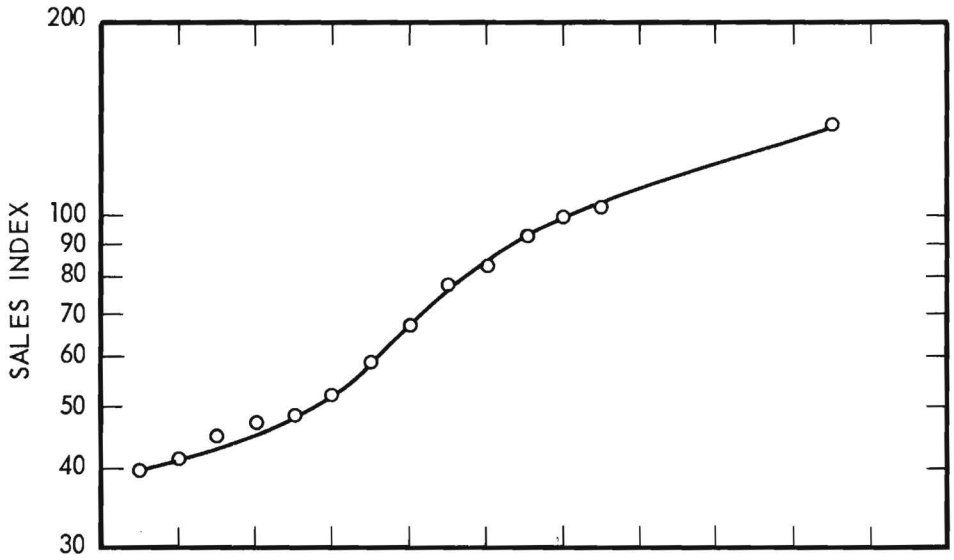
Appendix Table 2-A

ANNUAL PHARMACEUTICAL SALES DATA

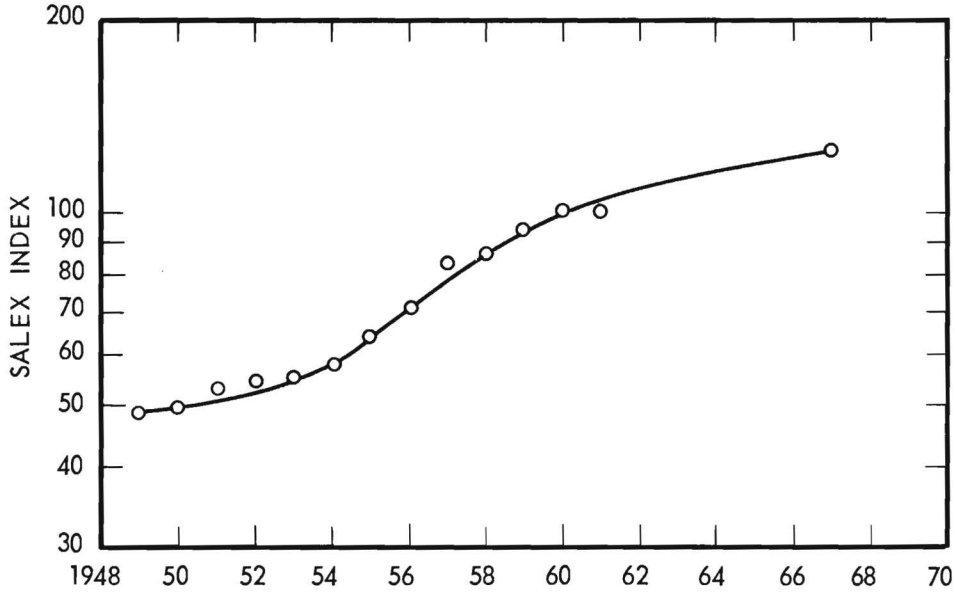
Year	Sales[1/]	Change from Previous Year	Sales Index 1960 = 100	Sales Per Capita	Per Capita Index 1960 = 100
1961	$3,715,740,000	+3.4%	103.4	$20.23	101.76
1960	3,592,550,000	+7.7%	100.0	19.88	100.00
1959	3,334,620,000	+10.9%	93.8	18.81	94.61
1958	3,007,060,000	+6.2%	83.7	17.28	86.92
1957	2,830,730,000	+16.8%	78.9	16.53	83.14
1956	2,423,620,000	+14.9%	67.5	14.41	71.12
1955	2,110,010,000	+12.4%	58.7	12.77	64.23
1954	1,877,230,000	+7.2%	52.2	11.56	58.14
1953	1,751,150,000	+2.4%	48.7	10.97	55.18
1952	1,710,110,000	+4.6%	47.6	10.89	54.77
1951	1,634,900,000	+9.4%	45.5	10.59	53.26
1950	1,494,420,000	+3.7%	41.6	9.85	49.54
1949	1,441,100,000	-	40.1	9.66	48.59
1967 -- from Appendix Figure 2-B				$24.50	123.23

1/ The year 1954 and earlier years are adjusted to the same base as the later years by using the percent of change.

APPENDIX FIGURE 2-A
PHARMACEUTICAL SALES INDEX



APPENDIX FIGURE 2-B
PER CAPITA SALES INDEX FOR PHARMACEUTICALS



Industrial Development Division
Engineering Experiment Station
GEORGIA INSTITUTE OF TECHNOLOGY

The per capita sales for 1967 were estimated, using Appendix Figure 2-B. The sales history for the past 13 years was studied by forecasters of the Industrial Development Division who made the estimate.

The per capita sales figure is multiplied by an authoritative forecast of population[1/] for 1967 for both the U. S. and the 11-state area. The forecast for 1967 for the U. S. and the 11-state area is 37.28% increase over 1960. The calculations are shown below:

Per capita sales from Appendix Figure 2-B	$ 24.50
Per capita sales index, 1960 = 100	123.23

Population:

Year	U. S.	11-State Area[2/]
1960	179,323,175	42,570,522
1967	199,766,000	47,423,600
Percent increase:	11.4%	11.4%

1967 population index, 1960 = 100: 111.4

1967 sales index from population index × per capita sales index:

111.4 × 123.23 = 137.28 or 37.28% increase in 1967 over 1960

The McGraw-Hill Department of Economics forecast production to increase 150% by 1975 over 1960. The 1967 production, by using the average rate of growth method, would be 54% above 1960. Therefore, for both the production and sales forecast to be accurate, substantial price deflation would also occur. The Wholesale Price Index of Drugs and Pharmaceuticals (Appendix Table 2-B) has shown only small variations and actually register deflation from 1949 through 1961.

1/ U. S. News and World Report Population Forecast for 1970.

2/ The 11-state population estimate for 1967 is made from individual state estimates and not, as the percentages suggest, by using the same percentage of the U. S. as in 1960.

Appendix Table 2-B

WHOLESALE PRICE INDEX OF DRUGS AND PHARMACEUTICALS
(1960 = 100)

1961	97.1
1960	100.0
1959	98.5
1958	99.4
1957	98.6
1956	97.4
1955	98.1
1954	99.3
1953	98.2
1952	97.8
1951	101.1
1950	97.8
1949	98.9

More recently Charles A. Hampton of Abbott Laboratories' Commercial Development Division authored a report "Ethical Drugs"[1/] in which he forecast an increase of over 90% from 1960 to 1967. The statistical technique involved five multiple regression models, providing sophisticated forecasting.

1/ Hampton, Charles A., "Ethical Drugs, CW Report," Chemical Week, November 17, 1962, p. 134.

Appendix 3

DETERMINATION OF FREIGHT COST

To determine the freight cost for serving the national market, the national market is divided into 37 service areas[1/] as shown on Appendix Map 3-A. A central city in each area represents the destination of the shipments to that area. Appendix Table 3-A shows the area number, the central city, and the per cent of U. S. sales of ethical drugs in each area. The other information needed to calculate the freight bill as a percent of sales is the freight rate for each origin-destination pair, and a factor for converting dollar sales volume to shipping weight.

The following mathematical relationships are used:

$\mathbb{Z}$ - Service areas's percent of U. S. sales.

S - Dollar volume of the plant sales.

f - Factor that converts dollar volume sales to hundreds of pounds of shipping weight, CWT/$ of sales.

y - Freight rate to central city in service area.

B - Freight bill to specific service area.

$$B = (\mathbb{Z})(S)(f)(y)$$

$$\text{Total } B = \mathbb{Z}_1 Sfy_1 + \mathbb{Z}_2 Sfy_2 + \mathbb{Z}_3 Sfy_3 + \text{etc.}$$

$$\text{Total } B = Sf(\mathbb{Z}_1 y_1 + \mathbb{Z}_2 y_2 + \mathbb{Z}_3 y_3 + \text{etc.})$$

Freight bill as percent of the plant's sales =

$$\frac{\text{Total } B}{S} = f(\mathbb{Z}_1 y_1 + \mathbb{Z}_2 y_2 + \mathbb{Z}_3 y_3 + \text{etc.})$$

The results of the freight calculation are shown in the text. The factor for converting sales to shipping weight was picked for convenience to be one pound to one dollar of sales. Examination of ratios for some actual products displayed a range of from 0.1 pound per dollar of sales to six pounds per dollar of sales. Consulting with people in the pharmaceutical industry, the $1 per pound average was favored.

Appendix Table 3-A indicates the service areas that were used to compute shipping cost to the freight advantage area.

1/ Designated wholesale drug areas by the National Wholesale Druggists' Association.

Appendix Table 3-A

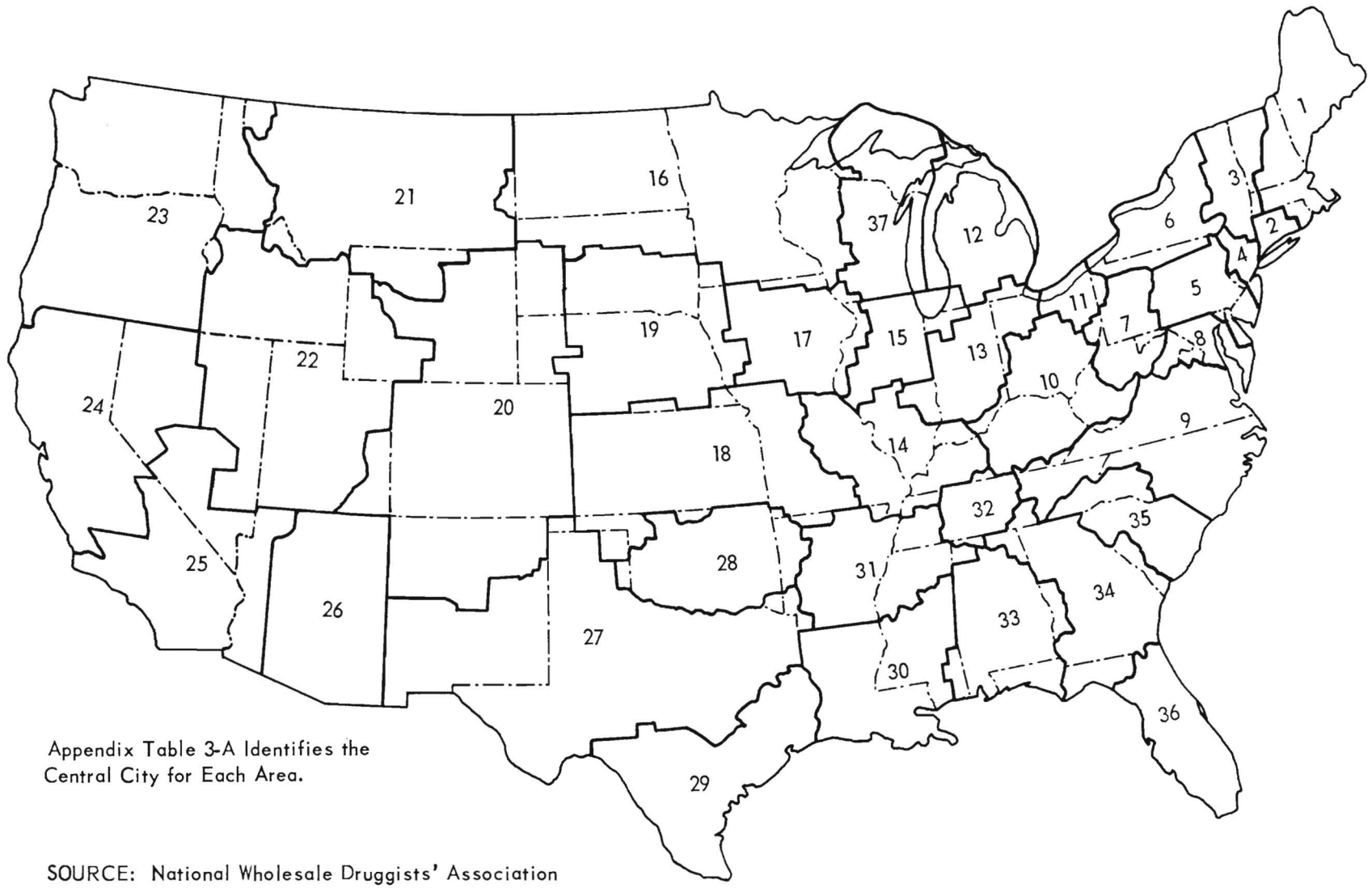
CENTRAL CITIES FOR SERVICE AREAS

Area Number	Central City	Area Percent of U. S. Sales
1	Boston	4.4196
2	Hartford	1.2727
3	Albany, N. Y.	.9848
4	New York City	9.7098
5	Philadelphia	5.2984
6	Syracuse	2.4470
7	Pittsburgh	2.3066
8	Baltimore	2.7020
9	Richmond*	3.4044
10	Cincinnati	4.0248
11	Cleveland	2.1907
12	Detroit	3.7057
13	Indianapolis	2.3931
14	St. Louis	2.6965
15	Chicago	5.5607
16	Minneapolis	2.5440
17	Des Moines	1.4835
18	Kansas City, Mo.	2.5274
19	Omaha	1.1768
20	Denver	1.6922
21	Butte	.4315
22	Salt Lake City	.7515
23	Seattle	3.1664
24	San Francisco	4.5168
25	Los Angeles	4.5194
26	El Paso	.6381
27	Dallas*	3.7772
28	Oklahoma City	1.6578
29	Houston*	2.5769
30	New Orleans*	2.7779
31	Memphis*	1.5420
32	Nashville*	.5790
33	Birmingham*	1.9459
34	Atlanta*	2.3306
35	Charlotte*	1.7978
36	Miami*	2.2885
37	Milwaukee	1.7748

* Area used to calculate the freight advantage area for a Georgia branch plant.

APPENDIX MAP 3-A

SERVICE AREAS USED IN FREIGHT COST CALCULATIONS



Appendix Table 3-A Identifies the Central City for Each Area.

SOURCE: National Wholesale Druggists' Association